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# CHEETAL

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### Photographing Butterflies

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Butterflies, with their variety of form and colour, make very attractive subjects for interested nature photographers, and the resulting photographs, if well taken, never fail to arouse more than just a passing interest in a lay observer, while serving to facilitate a closer observation and understanding of these insects; for, usually one cannot get a closer look at a flitting butterfly to be able to state much beyond, say for instance, that 'it's a beautiful, bright blue' or a 'lovely yellow' or things to that effect. One can kill a butterfly of course, diligently pressing it between the pages of a book—it can enable one to have the closest observation possible, but nil as far as other aspects of its biology are concerned. Frankly, I find this activity repulsive—whether for pressing between books or as drawing room adornments in transparent—base bowls.

Photographing butterflies, although it does require a little bit of specificity of equipment, and a great deal of specificity of character, can by no means be said to be the preserve of the specialist. Pursued solely as a hobby by amateurs, it is as fulfilling and rewarding a pursuit, as, say birdwatching. As a beginner myself, I can vouch to the immense sense of achievement that follows pulling the shutter and 'bagging' a particularly elusive and beautiful butterfly that has been frustrating all your previous attempts. As a purely commercial proposition, I should think that photographs of butterflies, pretty creatures as they are, and coupled with their propensity for settling on flowers, are probably front-ranking 'models' of nature, and may be much in demand. However, since I have no experience regarding this aspect, I cannot say anything more. The following account is a narration of personal observations and experiences in the course of photographing some common garden butterflies.

The whole exercise of choice of equipment, and techniques of photography, is geared towards one basic objective—to get as large an image of the subject on the film as possible,



so that the resulting enlargements retain as much of sharpness and details. This is true for all of nature photography, and the means of achieving it vary with the subject you're out to photograph. Butterflies being highly mobile creatures, rarely stationary except when feeding or resting (and that too not long), a single lens reflex camera with its rapidity and accuracy of focussing confers an unparalleled advantage. The opportunities that are presented are so fleeting that the lesser the number of camera controls that one has to adjust, the better. In this regard, modern-day cameras with their automation have greatly eased the photographers' task. The ideal mode that I prefer is to have control over the speed (i.e., shutter-priority) and let the camera do the rest. Even the speed I have not felt the need to alter every time, and either 1/125 second or 1/250 second is an admirably acceptable speed for most occasions except when photographing butterflies such as the Common Mormon, which keep flapping their wings even when feeding on flowers—then of course, one may be constrained to use 1/500 second or higher. It may seem paradoxical that for so fast and restless a creature as a butterfly a comparatively 'low' shutter speed as 1/125 sec. should suffice. True, they're fast and mobile, and unpredictably so at that, but to such an extent, in fact, that it is near impossible to photograph them in actual flight—succeeding in doing so is purely a matter of chance. It's only when they're resting that they can be photographed (and that's the reason why almost all the photographs that you see of butterflies are of either sipping nectar from flowers, or resting on leaves or twigs or on the ground). But within this frame of time when they're resting, they exhibit very little movement, and one can use these low speeds (I've used even 1/60 sec. speed on many occasions to get excellent results). And this is also the reason for choosing low speed film (ASA 100 is ideal for most work) to take advantage of its greater resolution, very fine grain and colour quality. As far as lenses are concerned, close-focussing lenses are preferred, in the focal length range of 25-35 mm, (the standard camera lens being 50-55 mm), although I've used a 200 mm one for some very good pictures of common mormons that were inaccessible for a close-up shot; but any lens of a great enough focal length to make hand-held shooting impractical is to be considered unsuitable. The ideal I've found to be a 28-85 mm zoom lens, which I used mostly at 28 mm, at which setting it was able to focus about 9.5 cms. in front of it, giving an image on the film which was approx. one-fourth life-size. From such a negative (if you're using colour negative or black and white film) there is no detectable loss of sharpness or detail even at an 8 in. × 10 in. sized enlargement, which would have a slightly larger-than-life image of the butterfly. To summarize then—an SLR camera, a close focussing lens and a low speed film.

Since the greatest details are registered on photographing the butterflies up close, stalking them is the most suitable method. By 'up close' I imply a distance of a foot or less. And this is the nub of the whole affair—to be able to get the better of the wariness of a naturally alert subject. The big thing is to get your butterfly in focus at that close a range.



Once that is done, then it is simply a matter of pressing the shutter—the physics and chemistry of the exposure on the film being taken care of largely by the camera. This is what gives the whole activity an element of as exciting a sport as any—the thrill of achievement, the near-misses and disappointments, even suspense—they're all there. And may I point out here that those 'near-misses' far outnumber the successes, for there can be no sure shot photograph—not until you've actually taken one. Therefore two of the most vital prerequisites (aside from having a camera, of course), are loads of patience and perserverence; this is what I had meant by the specificity of character referred to earlier.

At the outset, I'd like to emphasize that there is no such thing as THE TECHNIQUE of butterfly photography. One can only give some basic facts and broad outlines along which to work out the best compromise. Many of the basics are similar to those of bird photography. Thus neutral coloured clothing certainly helps, but what is most important is never to make any sudden, sharp movements; rather, 'creeping' and slow motion movements must be the bywords. Butterflies largely depend upon their sense of vision to stay tuned in to their surroundings. In this their compound eyes and slim bodies serve them well by giving a very wide angle of view. The better method, therefore, is to wait for a butterfly to settle on a flower or a twig, and gradually approach it from the rear, taking care, as one gets closer, not to strike or get entangled in any vegetation which can shake the stem on which the butterfly is perched, for any such sharp movement will cause it to go flitting off. This is sometimes difficult to do when concentrating on the butterfly through the camera, but it always helps to take in a layout of the surroundings and to keep an occasional eye out for such things. Butterflies are definitely able to distinguish between movements thus caused and those brought about by the wind, for the swaying of the branches and stems due to the latter will not send it fluttering away. Whether they're able to differentiate between the rhythmical swaying caused by the wind, and the perceptibly, jerky movement caused by any object shaking the vegetation, or, its the 'feel' of the wind that is important—movement in its absence being construed as alarming—I cannot say, but definitely the tendency would be to hold on tight the faster the wind blows, to avoid being blown away.

That vision is more important than smell in locating their food source is shown by the fact that butterflies are attracted to bright, conspicuous flowers, but whether there is any association between a particular flower and a particular species of butterfly, I have not been able to determine. Certainly all types of common garden butterflies are partial towards a lantana clump in full bloom, (so are the bees, and may be this could be a factor in its efficient seed production and equally efficient dispersal by birds, leading to its being widespread). Perhaps some reader may be able to enlighten us on how to plant a butterfly garden'. An interesting observation that I'd like to give is that during the month of March



in Dehra Dun the leechi trees are in full bloom with minute, light green blossoms, which, although they're glistening with droplets of sweet sap, do not attract very many butterflies (rather they're swarming with honey-bees, and moths at night) which perhaps lends credence to the fact that butterflies rely primarily on their vision, and that bright, conspicuously coloured flowers are meant for them.

Whenever a butterfly sits on a flower to sip nectar, it does not start doing so straight away; rather, there is always a period of about 2 to 5 seconds before it unrolls its proboscis and sends it probing down into the flower. If it does not encounter any nectar, then it withdraws its proboscis within 1 to 2 seconds, but if it does find a substantial store of nectar, then there is a distinct air of 'settling down to feed in earnest'—there is a slight re-alignment of the legs, and the body, particularly the anterior portion, dips down slightly, and stays so for at least 5 seconds (may be more) before withdrawing its proboscis and moving to another flower or floret. The importance of this observation lies in the fact that before the butterfly has inserted its proboscis, it seems to be very wary, and even a slight movement close by, howsoever gradual, will alarm it away. Similar is the case if it inserts its proboscis, and, not encountering any nectar, withdraws it within 1-2 seconds. But once it has perceptibly dipped its body and re-aligned its legs somewhat, it seems to become oblivious to the surroundings to a considerable degree, and will many a times even ignore a careless, unintended jerk of the camera lens looming so near it! The crucial thing, therefore, is to wait when a butterfly has settled on a flower and watch its proboscis (its normally seen curled like a watchspring in front of the insect's head)—only when it has uncurled it and has then 'shuffled' and dipped its body as stated above, should one try to move in any closer. Odd though this may seem, yet it very definitely makes the difference between taking and missing a picture. As regards an explanation of this phenomenon, I have no clue, and would be only too glad to hear from anyone in this regard. The compound eye of insects is composed of many small lenses that form simple multiple images of an object—sort of a mosaic pattern. As the object moves in front of the eye, the pattern of images immediately changes, giving great sensitivity to movement. As to why the butterfly should become more tolerant to movement (since the eye is fixed and cannot be directed away in another direction) when sipping nectar, is a mystery to me. Yet this is undeniably the case (and fortunately so). Or are insects capable of redirecting their faculties from one activity to another?

Butterflies are most numerous in Dehra Dun in spring, during the months of February-March, and in the post-monsoon period, September-November, when there's a profusion of vegetation all around. Most are active in the mornings and late afternoons. The latter is the most suitable time for chasing them with a camera, especially in the autumn months, because the sun is low and the light is not too harsh. If photographing in direct sunlight, it



is best to use the manual mode of the camera and underexpose one stop below that indicated by the camera's sensors, because the latter are overly influenced by the dark vegetation, and the butterfly is overexposed on the film with consequent loss of detail; this is especially true when photographing light-coloured butterflies like the whites and the Yellows. There are some butterflies which are most active at dusk and dawn. Prominent amongst them are Skippers—small, grey brown butterflies with a quick, fitting flight that are found mostly amongst grasses and small plants in the evenings. A separate flash unit is needed, for if one is to photograph them close up, then a flash unit attached to the camera is unsuitable.

For those who are fortunate enough to have easy access to the unspoilt outdoors, forest glades and stream banks are the favourite haunt of many species not encountered in the gardens. The opportunities for learning are limitless—learning not just photographic skills, but learning to observe things minutely, to analyse and understand, learning to appreciate and respect.

Before concluding, I'd like to state that I have not come across much literature on this particular subject, and would like to solicit the views and experiences of any interested readers to expand, reinforce, or question those of my own.

—Sameer Swami

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No. 526 |  | Encl. No. 527 |  | Encl. No. 528 |  | Encl. No. 529 |  | Encl. No. 530 |  | Encl. No. 531 |  | Encl. No. 532 |  | Encl. No. 533 |  | Encl. No. 534 |  | Encl. No. 535 |  | Encl. No. 536 |  | Encl. No. 537 |  | Encl. No. 538 |  | Encl. No. 539 |  | Encl. No. 540 |  | Encl. No. 541 |  | Encl. No. 542 |  | Encl. No. 543 |  | Encl. No. 544 |  | Encl. No. 545 |  | Encl. No. 546 |  | Encl. No. 547 |  | Encl. No. 548 |  | Encl. No. 549 |  | Encl. No. 550 |  | Encl. No. 551 |  | Encl. No. 552 |  | Encl. No. 553 |  | Encl. No. 554 |  | Encl. No. 555 |  | Encl. No. 556 |  | Encl. No. 557 |  | Encl. No. 558 |  | Encl. No. 559 |  | Encl. No. 560 |  | Encl. No. 561 |  | Encl. No. 562 |  | Encl. No. 563 |  | Encl. No. 564 |  | Encl. No. 565 |  | Encl. No. 566 |  | Encl. No. 567 |  | Encl. No. 568 |  | Encl. No. 569 |  | Encl. No. 570 |  | Encl. No. 571 |  | Encl. No. 572 |  | Encl. No. 573 |  | Encl. No. 574 |  | Encl. No. 575 |  | Encl. No. 576 |  | Encl. No. 577 |  | Encl. No. 578 |  | Encl. No. 579 |  | Encl. No. 580 |  | Encl. No. 581 |  | Encl. No. 582 |  | Encl. No. 583 |  | Encl. No. 584 |  | Encl. No. 585 |  | Encl. No. 586 |  | Encl. No. 587 |  | Encl. No. 588 |  | Encl. No. 589 |  | Encl. No. 590 |  | Encl. No. 591 |  | Encl. No. 592 |  | Encl. No. 593 |  | Encl. No. 594 |  | Encl. No. 595 |  | Encl. No. 596 |  | Encl. No. 597 |  | Encl. No. 598 |  | Encl. No. 599 |  | Encl. No. 600 |  | Encl. No. 601 |  | Encl. No. 602 |  | Encl. No. 603 |  | Encl. No. 604 |  | Encl. No. 605 |  | Encl. No. 606 |  | Encl. No. 607 |  | Encl. No. 608 |  | Encl. No. 609 |  | Encl. No. 610 |  | Encl. No. 611 |  | Encl. No. 612 |  | Encl. No. 613 |  | Encl. No. 614 |  | Encl. No. 615 |  | Encl. No. 616 |  | Encl. No. 617 |  | Encl. No. 618 |  | Encl. No. 619 |  | Encl. No. 620 |  | Encl. No. 621 |  | Encl. No. 622 |  | Encl. No. 623 |  | Encl. No. 624 |  | Encl. No. 625 |  | Encl. No. 626 |  | Encl. No. 627 |  | Encl. No. 628 |  | Encl. No. 629 |  | Encl. No. 630 |  | Encl. No. 631 |  | Encl. No. 632 |  | Encl. No. 633 |  | Encl. No. 634 |  | Encl. No. 635 |  | Encl. No. 636 |  | Encl. No. 637 |  | Encl. No. 638 |  | Encl. No. 639 |  | Encl. No. 640 |  | Encl. No. 641 |  | Encl. No. 642 |  | Encl. No. 643 |  | Encl. No. 644 |  | Encl. No. 645 |  | Encl. No. 646 |  | Encl. No. 647 |  | Encl. No. 648 |  | Encl. No. 649 |  | Encl. No. 650 |  | Encl. No. 651 |  | Encl. No. 652 |  | Encl. No. 653 |  | Encl. No. 654 |  | Encl. No. 655 |  | Encl. No. 656 |  | Encl. No. 657 |  | Encl. No. 658 |  | Encl. No. 659 |  | Encl. No. 660 |  | Encl. No. 661 |  | Encl. No. 662 |  | Encl. No. 663 |  | Encl. No. 664 |  | Encl. No. 665 |  | Encl. No. 666 |  | Encl. No. 667 |  | Encl. No. 668 |  | Encl. No. 669 |  | Encl. No. 670 |  | Encl. No. 671 |  | Encl. No. 672 |  | Encl. No. 673 |  | Encl. No. 674 |  | Encl. No. 675 |  | Encl. No. 676 |  | Encl. No. 677 |  | Encl. No. 678 |  | Encl. No. 679 |  | Encl. No. 680 |  | Encl. No. 681 |  | Encl. No. 682 |  | Encl. No. 683 |  | Encl. No. 684 |  | Encl. No. 685 |  | Encl. No. 686 |  | Encl. No. 687 |  | Encl. No. 688 |  | Encl. No. 689 |  | Encl. No. 690 |  | Encl. No. 691 |  | Encl. No. 692 |  | Encl. No. 693 |  | Encl. No. 694 |  | Encl. No. 695 |  | Encl. No. 696 |  | Encl. No. 697 |  | Encl. No. 698 |  | Encl. No. 699 |  | Encl. No. 700 |  | Encl. No. 701 |  | Encl. No. 702 |  | Encl. No. 703 |  | Encl. No. 704 |  | Encl. No. 705 |  | Encl. No. 706 |  | Encl. No. 707 |  | Encl. No. 708 |  | Encl. No. 709 |  | Encl. No. 710 |  | Encl. No. 711 |  | Encl. No. 712 |  | Encl. No. 713 |  | Encl. No. 714 |  | Encl. No. 715 |  | Encl. No. 716 |  | Encl. No. 717 |  | Encl. No. 718 |  | Encl. No. 719 |  | Encl. No. 720 |  | Encl. No. 721 |  | Encl. No. 722 |  | Encl. No. 723 |  | Encl. No. 724 |  | Encl. No. 725 |  | Encl. No. 726 |  | Encl. No. 727 |  | Encl. No. 728 |  | Encl. No. 729 |  | Encl. No. 730 |  | Encl. No. 731 |  | Encl. No. 732 |  | Encl. No. 733 |  | Encl. 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# Some Observations on Breeding of Red Junglefowl (*Gallus gallus*)

By

R.S. Bhadauria

Addl. Chief Wild Life Warden, Uttar Pradesh, Lucknow

(Continued from Vol. 28, No. 2)

I had reported my observations made during 1986 breeding season regarding egg laying by Red Junglefowl in captivity, in Cheetal—Vol. 28, No. 2 and had concluded that the hen possesses about 8 ovarian follicles. But the observations recorded during 1987 laying season on the same birds gave different results as far as number of eggs per hen is concerned. However the period and pattern of laying remained same as in previous year.

This year six pairs, kept separately in different enclosures on the same diet as last year, were studied and the eggs laid were collected daily. The pattern of laying and numbers of eggs laid were observed as under:

| Encl. No. 1    |            | Encl. No. 2    |            | Encl. No. 3    |            | Encl. No. 4    |            | Encl. No. 5    |            | Encl. No. 6    |            |
|----------------|------------|----------------|------------|----------------|------------|----------------|------------|----------------|------------|----------------|------------|
| Date of laying | No. of egg | Date of laying | No. of egg | Date of laying | No. of egg | Date of laying | No. of egg | Date of laying | No. of egg | Date of laying | No. of egg |
| 1              | 2          | 3              | 4          | 5              | 6          | 7              | 8          | 9              | 10         | 11             | 12         |
| 12.4.87        | 1          | 14.4.87        | 1          | 12.3.87        | 1          | 27.3.87        | 1          | 5.3.87         | 1          | 9.3.87         | 1          |
| 14.4.87        | 1          | 24.4.87        | 1          | 14.3.87        | 1          | 1.4.87         | 1          | 7.3.87         | 1          | 10.3.87        | 1          |
| 17.4.87        | 1          | 27.4.87        | 1          | 15.3.87        | 1          | 5.4.87         | 1          | 8.3.87         | 1          | 14.3.87        | 1          |
| 23.4.87        | 1          | 5.5.87         | 1          | 17.3.87        | 1          | 12.4.87        | 1          | 11.3.87        | 1          | 17.3.87        | 1          |
| 24.4.87        | 1          |                |            | 31.3.87        | 1          | 13.4.87        | 1          | 19.3.87        | 1          | 21.3.87        | 1          |
| 3.5.87         | 1          |                |            | 8.4.87         | 1          | 20.4.87        | 1          | 27.3.87        | 1          | 23.3.87        | 1          |
|                |            |                |            | 18.4.87        | 1          | 22.4.87        | 1          | 30.3.87        | 1          | 31.3.87        | 1          |
|                |            |                |            | 25.4.87        | 1          | 23.4.87        | 1          | 31.3.87        | 1          | 6.4.87         | 1          |
|                |            |                |            |                |            | 3.5.87         | 1          | 5.4.87         | 1          | 19.4.87        | 1          |
|                |            |                |            |                |            | 4.5.87         | 1          | 21.4.87        | 1          | 22.4.87        | 1          |
|                |            |                |            |                |            | 7.5.87         | 1          | 23.4.87        | 1          | 23.4.87        | 1          |
|                |            |                |            |                |            | 8.5.87         | 1          | 4.5.87         | 1          | 9.5.87         | 1          |
|                |            |                |            |                |            | 14.5.87        | 1          |                |            |                |            |
| Total          | 6          | 4              |            | 8              |            | 13             |            | 12             |            | 12             |            |



The conclusions drawn in my previous paper (Cheetal—Vol. 28, No. 2) need to be amended, to the extent that a Red junglefowl hen possesses more than 8 Ovarian follicles and it could be as high as 12-15. The present study confirms the laying capacity of 13 eggs and no wonder if still higher numbers are obtained during the next breeding season, which will be carefully observed and reported again. In natural conditions too, one of my doctor friend claims to have seen in the forest some years back a clutch of more than dozen eggs in a nest. This further confirms that egg laying capacity is definitely more than a dozen and the observation recorded in Dr. Salim Ali's Book—'Hand Book of the Birds of India and Pakistan' wherein the clutch size has been recorded as 5 to 6 eggs, needs to be amended.

The diet in captivity does not seem to have any effect on egg laying, because with the same diet the number of eggs laid by one of the hens, has been as low as 4. The variation in egg laying capacity seems to be individual factor. However, the disturbance and stress during breeding season apparently affects the egg laying as in the year 1985, when these birds were trapped and brought to breeding pens, little before the commencement of breeding season, only one hen laid a solitary egg.

### **Time of Laying**

One attendant was on duty to collect the eggs, whole day from the enclosures and the time of collection was noted in each case. It was found that time of egg laying ranged between 7.00 a.m. to 6.00 p.m. but the majority of eggs were laid between 8 to 10 in the morning and 3 to 5 in the afternoon. Thus junglefowl lay eggs between sunrise to sunset and any activity in the forest during any part of the day in breeding season will affect their laying potential.

### **Incubation Period**

Since the hens were dropping eggs in the enclosures at different places, daily picking and placing them under broody hen had to be resorted to. Date of laying was marked with indelible ink on each egg before placing it under broody and thus hatching period was ascertained. The records maintained reveal following results:—

| <b>Date of laying</b> | <b>Date of hatching</b> | <b>Incubation period</b> |
|-----------------------|-------------------------|--------------------------|
| 5.4.87                | 28.4.87                 | 23 days                  |
| 12.4.87               | 1.5.87                  | 19 "                     |
| 12.4.87               | 1.5.87                  | 19 "                     |
| 14.4.87               | 3.5.87                  | 19 "                     |
| 18.4.87               | 9.5.87                  | 21 "                     |
| 20.4.87               | 11.5.87                 | 21 "                     |
| 23.4.87               | 15.5.87                 | 22 "                     |
| 27.4.87               | 16.5.87                 | 19 "                     |



Thus the period of incubation varies from 19 days to 22 days and occasionally it may go even up to 23 days.

### References

1. Salim Ali and S. Dillon Ripley—Hand Book of the Birds of India and Pakistan.
2. Bhadauria, R.S.—Breeding Red Junglefowls in captivity. Cheetal, Vol. 28, No. 2.

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### Incubation Period

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| Incubation period | Date of hatching | Date of laying |
|-------------------|------------------|----------------|
| 23 days           | 26.4.87          | 2.4.87         |
| 19 "              | 1.5.87           | 12.4.87        |
| 19 "              | 1.5.87           | 12.4.87        |
| 19 "              | 3.5.87           | 14.4.87        |
| 21 "              | 9.5.87           | 18.4.87        |
| 21 "              | 11.5.87          | 20.4.87        |
| 22 "              | 12.5.87          | 23.4.87        |
| 19 "              | 16.5.87          | 27.4.87        |



## Jatinga Bird Mystery

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Jatinga is a beautiful small village of well to do and culturally rich Jayantia tribals in the North Cachar Hill District of Assam. It is situated in the vicinity of Barail Hill Range of North Cachar Hills and is going to represent itself on the World Wild Life Map due to an unique phenomenon of birds observed in the months of August, September and October every year. The Jatinga Valley is delineated on the South-West by river Dolong and on the West by river Jatinga. For the Jatinga Valley the Barail Hill Range acts as a barrier in South extending towards North east and South-West directions. The altitude of the Barail Range varies from 1000 metres to 1500 metres, the highest peak Heimpeupet being 1571 metres high. The forests of lofty, foggy, bluish Barail Hill Range come under the category of moist-semi-evergreen forests and are approximated to the type 2 BC/1b and 2 BC/2 of Champion and Seth's classification. The top storey consists mainly of species like *Artocarpus chaplasa*, *Amoora wallichii*, *Duabanga* spp., *Dysoxylum* spp., *Gmelina arborea*, *Michelia champaca*, *Masonia depikae*, *Morus lavigata*, *Phybe goalparensis*, *Schima wallichii*, etc.

During the months August, September and October the birds of various kinds and various habits are attracted to lights on rainy days when the wind is blowing from South-West direction and the weather is foggy. The drizzling moonless, foggy nights coupled with South-Westerly wind blowing with moderate speed provide most favourable condition for attraction of the colourful birds towards light in the vicinity of Jatinga village. This unique phenomenon of bird congregation remains for a few days only in a year during months August to October. This peculiar behaviour of birds in the above mentioned months under such particular weather conditions has attracted the global interest of ornithologists and environmentalists. What causes the attraction of birds towards light source under a particular set of weather conditions at Jatinga still remains a mystery to be resolved?

The story behind the phenomenon goes back to 1885 when some Jeme Nagas from the neighbouring villages camping at Jatinga to protect their crops from wild animals observed the congregation of birds around their camp fire. These Jeme Naga Cultivators (*Jhummiyas*) considering it an act of devil left the place and sold it to Jayantia people for a meagre amount. The Jayantia settlers also experienced the phenomenon but unlike the Jeme Nagas they caught some birds out of enjoyment and being non-vegetarians tasted them which since then became a regular features of the villagers to catch the birds by lightening,



kill them as a part of their sport, enjoyment and food. Now it can also be said in other words as the customary habit of Jayantia tribals of Jatinga village.

The fubilant youths of Jatinga and nearby places, in order to trap the birds keep a bright light (Patromax or Wooden torch) in open during dark, foggy nights with drizzling or moderate rains. To protect the patromax or light sources from rain they put polythene or bamboo mats on top and around three sides of the light source. The people wait eagerly and with patience for the whole night near the light source with long flexible bamboo poles. As soon as the birds from opposite direction of the wind start conversing towards the light, they are killed and sometime caught or injured by these people.

Sometimes the birds even clash against the vehicle lights passing through the Jatinga valley and doors and windows of the houses in the village.

It is worthwhile to mention in brief about different birds commonly sighted at Jatinga and nearby places such as Haflong, Vapu, Pura and Harangajao and also different varieties of the colourful birds commonly attracted towards light leading to the mystery phenomenon. The common birds at Jatinga and nearby places which cannot miss the eyes of any person are spotted dove, large pied wagtail, common myna, hill myna, black drango, green bulbul and red vented bulbul. A list of some common birds is given in Table 1.

The birds which are attracted towards light during the months August to October every year on dark, cloudly nights under a particular set of weather conditions leading to the mysterious bird phenomenon include some of the birds mentioned in Table 1 such as spotted dove, black drango, blue legged bustard quail, besides a large list of other birds. A list of birds which congregate towards light at Jatinga during the occurrence of the phenomenon is given in Table 2.

The most common birds congregating towards the light source during phenomenal nights are Indian ruddy kingfisher, Indian three toed forest kingfisher, Indian pitta, green breasted pitta, green pigeon and Koel.

The general behaviour of the birds attracted towards light is an interesting point of study. In a study made by the author during the hours of occurrence of the phenomenon at Jatinga in the month September 1986 the following observations were made on behaviour of the birds.



Table 1

Some common birds of Jatinga\*

| Sl. No. | English Name         | Scientific Name                                    | Local/Hindi Name    | Remarks                                        |
|---------|----------------------|----------------------------------------------------|---------------------|------------------------------------------------|
| (1)     | (2)                  | (3)                                                | (4)                 | (5)                                            |
| 1.      | Spotted dove         | <i>Sterptopelia chinensis</i>                      | Chhota fakhta       | Very common to Jatinga.                        |
| 2.      | Large pied wagtail   | <i>Motacilla maderaspatensis</i>                   | Dhoban              | Visitor to Assam in winters. Occsionally seen. |
| 3.      | Hill myna            | <i>Gracula religiosa</i>                           | Phari-myna          | Restricted and seen patchy in distribution.    |
| 4.      | Common myna          | <i>Acridotheres ginginianus</i>                    | Desi myna           | Very common to Jatinga.                        |
| 5.      | Red vented Bulbul    | <i>Pycnonotus cafer</i>                            | Bulbul              | Very common to Jatinga.                        |
| 6.      | Red Whiskered Bulbul | <i>Pycnonotus cafer</i><br><i>Pycnonotus cafer</i> | Pyhari-Bulbul       | Very common to Jatinga.                        |
| 7.      | Green Bulbul         | <i>Chloropsis surifrons</i>                        | Hera Bulbul         | Very common to Jatinga.                        |
| 8.      | Mapie-Robin          | <i>Copsychus saularis</i>                          | Daiya               | Very common to Jatinga.                        |
| 9.      | Large Cuckoo-Shrike  | <i>Coracina novalholladie</i>                      | Kasya               | Four races recognised.                         |
| 10.     | Black Draggio        | <i>Dicrurus adsimilis</i>                          | Bhujanga Hoga-ganga | Four races are recognised.                     |

(Contd.)



| (1)                           | (2)                          | (3)                 | (4)                                      | (5) |
|-------------------------------|------------------------------|---------------------|------------------------------------------|-----|
| 11. Greytit                   | <i>Parus major</i>           | Ramgowgra           |                                          |     |
| 12. Tree pie                  | <i>Dendrositta vagabanda</i> | Mahalat             |                                          |     |
| 13. Red Jungle fowl           | <i>Gallus gallus</i>         | Jungli Murgi        | Common to drier nearby place of Jatinga. |     |
| 14. Red Spur fowl             | <i>Galloperdix spadicea</i>  | Chhoti Jungli murgi | Common to drier nearby place of Jatinga. |     |
| 15. Blue legged bustard quail | <i>Turnix suscitator</i>     | Gulu, Gindra        | Common to drier nearby place of Jatinga. |     |
| 16. The Jungle-babbler        | <i>Turdoides somervillei</i> |                     | Common to drier nearby place of Jatinga. |     |

\* Water birds are seldom sighted during day hours at Jatinga and nearby places.

Table 2

Birds sighted during congregate phenomenon at Jatinga

| Sl. No. | English Name                        | Scientific Name                    | Local/Hindi Name         | Remarks                                                                         |
|---------|-------------------------------------|------------------------------------|--------------------------|---------------------------------------------------------------------------------|
| (1)     | (2)                                 | (3)                                | (4)                      | (5)                                                                             |
| 1.      | Indian Ruddy Kingfisher             | <i>Halcyon coronamda coromanda</i> | Dao natu gajao (Kachari) | Resident, perhaps commoner than is apparent.                                    |
| 2.      | Indian three toed forest Kingfisher | <i>Ceyx erithacus</i>              |                          | Low-country dryzone species but enters wet zone in border area up to 2000 feet. |

(Contd.)



| (1) | (2)                       | (3)                               | (4)           | (5)                                                  |
|-----|---------------------------|-----------------------------------|---------------|------------------------------------------------------|
| 3.  | Indian Pitta              | <i>Pitta brachyura</i>            | Naorang       | Local migratory.)                                    |
| 4.  | Green Pegion              | <i>Teron phoenicoptera</i>        | Harrial       | Local migratory habit.                               |
| 5.  | Black bittern             | <i>Dupetor flavicollis</i>        |               | Noetural, shy bird delightening in dense.            |
| 6.  | White breasted water hen  | <i>Amaurornis phoenicurus</i>     | Jal-murgi     | Distributed throughout India up to base of Himalaya. |
| 7.  | Chestnut bitt-tern        | <i>Ixobrychus cinnamomeus</i>     | Lal-bagla     | Resident bird but local migratory list.              |
| 8.  | Cattle egret              | <i>Bubulcus ibis</i>              | Safed bagla   | Resident bird but local migratory list.              |
| 9.  | Koel                      | <i>Eudynamys scolopacea</i>       | Kokila, Koel  | Resident but locally migratory.                      |
| 10. | Hawk Cuckoo               | <i>Cuculus varius</i>             | Papiha        | Resident but locally migratory.                      |
| 11. | Black drango              | <i>Dicrurus adsimilis</i>         | Bhujomga      | Throughout India distributed.                        |
| 12. | Whistling duck            | <i>Dendrocyna javanica</i>        | Bhugamga      | Throughout India distributed.                        |
| 13. | Grey heron                | <i>Ardea cinerea rectirostris</i> | Bagla         | Resident throughout India.                           |
| 14. | House swift               | <i>Apus affinis</i>               | Batasi        | — do —                                               |
| 15. | Spotted dove              | <i>Straptopelia chinensis</i>     | Chhota fakhta | Throughout India distributed.                        |
| 16. | Blue legged bustard quail | <i>Turnix suscitator</i>          | Guiu, Gundra  | — do —                                               |

(Contd.)



| (1) | (2)                    | (3)                            | (4)          | (5)                                                                                     |
|-----|------------------------|--------------------------------|--------------|-----------------------------------------------------------------------------------------|
| 17. | Emerald dove           | <i>Chalcophaps indica</i>      | Gulu, Gundra | Affects bamboo forest to ever-green forests.                                            |
| 18. | Ashy Shrike            | <i>Artamus fuscus</i>          | Tariababil   | Patchy in distribution but throughout India. Locally migratory.                         |
| 19. | Pond heron             | <i>Ardeolagravii</i>           | —            | Resident throughout India.                                                              |
| 20. | Wood cock              | <i>Scolopax rusticola</i>      | —            | Winter visitor from Himalaya to other places.                                           |
| 21. | Wood pecker            | <i>Micropternus brachyurus</i> | Katphora     | Throughout India and Hills up to 5000 feet.                                             |
| 22. | Racket tailed drango   | <i>Dicrurus paradiseus</i>     | Bhangaray    | Patchy in distribution but throughout India.                                            |
| 23. | Pheasant tailed Jacana | <i>Hydrophasianus gus</i>      | Chirur Pihoo | Distributed throughout India.                                                           |
| 24. | Green breasted Pitta   | <i>Pitta sordida cucullata</i> | Phattim pho  | Resident with migratory habit. Affects moist deciduous and evergreen secondary forests. |
| 25. | Water cock             | <i>Gallicrex cinerea</i>       | —            | Emerging cautiously into penin cloudy overcast weather.                                 |
| 26. | Tiger bittern          | <i>Gorachius melanolophus</i>  | —            | Winter visitor.                                                                         |



1. Sometimes the birds coming from opposite direction of the wind dashed directly into the light source and felled down on the ground after injury.
2. Very often the birds seen coming from North-East direction and setting themselves on tree branches, bushes, sometimes even on ground making sound and getting themselves as if psychologically depressed.
3. The birds are also seen coming with high speed from North-East direction crossing the light source and flying towards North-West direction without setting themselves on trees or bushes nearby.
4. Sometimes the birds from North-East direction come towards the light and settle themselves on tree branches, bushes, building top for few minutes and then fly back in North-West direction.
5. The birds in a group of 15-20 numbers were seen flying above the flood light fixed at watch tower for about 10 minutes and then disappearing in different directions.
6. No bird was observed dead near the light source due to its repeated strike on light source or other hardy objects as is observed in case of insects in all most all parts of the country during rainy season.

It is also interesting to mention the behaviour of birds caught during their congregation phenomenon at Jatinga and kept in enclosures by the author, during the month of September 1986. The birds mostly being water birds initially refuse to take food. The three toed forosts kingfisher kept in enclosure started taking food from the second day while the Indian ruddy kingfisher refused to take even water for 3-4 days. Both of them survived for about a month. All the birds kept in enclosures by the author were tried to study their affinity towards light under dark room conditions and then putting a lamp in the room, but they do not move towards light which clearly reflects that it is the prevailing weather condition at Jatinga which initiates tendency of movement towards light in these birds. Sometimes the birds caught uninjured fly back again. But the way the Jubilant youths at Jatinga catch the birds during phenomenal nights there is seldom a chance of any birds being caught without any injury.

What causes to a class of birds under a particular set of weather conditions to congregate towards light at Jatinga is still a mystery. However, there is a general belief among a section of bird watchers at Jatinga that birds come towards light to commit suicide. In my opinion this proposition cannot be proved true if the general behaviour and movement of birds towards light is studied, Very often as mentioned earlier some birds settle themselves on tree bushes, building tops near light source and then fly back. Sometimes even



they cross above the light from one direction to other and do not return back. The suicidal approach can also be refuted with the involvement of very few birds sighted during day hours in the congregation phenomenon. Most of the birds being attracted towards light under a particular weather conditions are young ones rather immature water birds though resident but locally migrants in habit which are less accustomed to the weather conditions under which they congregate at Jatinga. So the proposition of more disillusionment to obtain shelter under such harsh weather conditions leading to the movement of locally migratory birds towards lighted places can not be ruled out. Salim Ali the authority on birds have also mentioned the regular visit of Indian ruddy kingfisher and Indian three toed forest kingfisher at lights on dark monsoon nights suggesting definite migration passage. Similar nocturnal falls have been recorded in lighted bungalows in the strails of Malacca in the autumn months, October to December.

The author is thankful to Shri K.N. Devgoswami, I.F.S., Conservator of Forests, Hills, Haflong for valuable suggestions and encouragement.

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## Flamingo Migration in Punjab

By

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The wetlands of Punjab, though not many, attract from far and near, many kinds of migrant birds such as painted storks, spoonbills, demoiselle cranes, bar-headed geese and tufted pochards. For the first time flamingoes were sighted in Punjab towards the end of last year.

Birds periodically migrate from their original places of habitat, when they become inhospitable, to warmer places where they easily find food for themselves. Generally, these birds of passage move along recognisable migration paths.

Flamingoes were sighted in huge numbers in the wetlands of Dhanpur in Bhatinda district and Lehal Kalan in Sangrur district. First information about the flamingo migration was provided by members of the Punjab State Wild Life Advisory Board, Mr. Hardit Singh Sidhu and Raja Shivdev Inder Singh.

### A Huge Lot

Brig. M.L. Dhar, A.V.S.M., a keen naturalist and Mr. S.K. Sinha, Deputy Commissioner of Patiala subsequently visited these wetlands. Brigadier Dar sighted 500 of them at Dhanpur and 700 at Lehal Kalan sometime in last December. The same month when I visited the Dhanpur area I saw a huge lot of them, approximately 5000.

The area of Dhanpur wet land is about 200 acres. It is an ideal place for the birds. The wetland is totally free of weeds and remains peaceful and undisturbed.

Flamingoes with their long and outstretched legs and slender necks presented an unforgettable sight in the evenings. In flight, the bright scarlet coverts, glistening in the sun and set off by the black wing border looked simply exquisite.

### A Beautiful Bird

Flamingo (*Phoenicopterus roseus pallas*) are long-legged water birds highly adapted to taking small water animals. Because of their overly long legs, they were formerly grouped with ciconiformes, but some zoologists considered them to be related to the Anatidae. The voice is geese like. The food of flamingo consists of small swimming crustacea, algae, and unicellular organisms which they sift out of the water with the back which has been transformed into a filtration apparatus. The lower mandible is large and at its cutting edge, looks as if it is inflated, the upper mandible on the other hand, is small and fits on the lower



one like a lid. Broad areas inside the back have lammellae. The fleshy tongue of the flamingo works back and forth like a piston while searching for food in water and mud.

Flamingoes are the type of bird which can be called "resident nomadic and locally migratory". They are found capriciously in the Indian Sub-Continent. They are highly gregarious and normally live in flocks and in vast congregations at their favourite feeding and nesting places.

In India only known breeding grounds are the flat expanses in the Rann of Kutch.

Besides flamingoes a large number of painted storks, spoonbill, tufted pochard, Bar-headed goose, Brahminy duck, mallard, Avocet, gadwal, Pintail, Sand-piper, demoiselle crane, black ibis, black winged stilt and little ringed plover can be seen at Lehal Kalan Sangrur and Dhanpur wetland Bhatinda.

### Likely Reasons

One can not be sure about the reasons of this large-scale migration but one of them may be the present water scarcity in Rajasthan. Another might be a feeling of security they find in Punjab because of the falling hunting pressure during the past three years. Hunters can not easily approach, much less move about, in these wetlands. From the wildlife point of view, therefore, these wetlands, though private, are of immense importance.

These two wetlands differ in many respects. The Lehal Kalan is almost double the size of Dhanpur and also has acacia trees inside the wetland area. Such trees are not found in Dhanpur. Lehal Kalan has also a natural mound for the roosting of birds.

Dr. Salim Ali, a known ornithologist clarified that in the last few years the area of Rann of Kutch has been under pressure and disturbance through human activity and the flamingoes no longer breed there. The birds now seem to have dispersed in small flocks to suitable places all over the country. He has also informed that with the loss of the breeding area in the Rann of Kutch, we have to now reassess the breeding grounds and distribution patterns of the flamingoes and report of sightings are reaching us from many places throughout the country.

### Harike Lake

Close to the Dhanpur wetland, 18 demoiselle cranes have been sighted in the Juglana area. They have not been spotted strangely enough, even in the Harike Lake, the biggest lake not only in Punjab but in the entire northern region.



The Harike Lake attracts the maximum number of waterfowl giving it the status of a bird sanctuary. The lake is 41 square kilometres in area extending to parts of Amritsar, Ferozepur and Kapurthala districts.

Altogether a total of 284 species of birds are found in Punjab. In collaboration with the Wildlife Preservation Department of Punjab, the Bombay Natural History Society has done good research work in the population structure of the avi-fauna in the Harike Lake and Shivalik areas and on bird movement. The research was done during 1980-85 period.

### Migration Paths

According to the studies carried out by the Society on the movement and the population structure of Indian avifauna, there appear to be two distinct bird migration passages, one in the west and the other in the east. In the west, the main concentration is at the Keoladeo Ghana National Park at Bharatpur in Rajasthan. The birds briefly halt at the Harike Lake. In the east, the concentration is at Point Calimere, on the southern coast of Tamil Nadu. The Chilka Lake in Orissa is the halting place.

A notable trend in the bird movement has been noticed. Some birds, ringed at Point Calimere, were recaptured at the Chilka Lake, but none at Bharatpur or the Harike Lake. Similarly, birds ringed at Bharatpur were recaptured in and around the Harike Lake, but none at Point Calimere or at Chilka. A significant habitat difference between the two areas is that, that Point Calimere and Chilka Lake on the Eastern coast have estuarine profile, while Bharatpur and the Harike Lake are situated in land and have a fresh water regime.

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# Population Structure and Dynamics of Tigers in Bandhavgarh National Park

By

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## Introduction

All living populations are dynamic, their monitoring in a time series and structural analysis are important considerations in understanding the ecology of an animal species and its management. Fluctuations of numbers almost invariably are accompanied by changes in structure. The study of population dynamics, therefore, provides knowledge of the internal workings of a population and gives a good indication of future changes in its growth and ecological relationship with the range.

The author had an opportunity to work in the study area (Bandhavgarh National Park) for more than 5 years as assistant director of the Park and had tried to study the population of trends of prey vis a-vis predator species in the said area.

In this paper an attempt has been made to show the structure dynamics and growth rate of tiger population in Bandhavgarh National Park as recorded from 1975 to 1984 through regular census operations.

Intensive protection and habitat development have caused an overall increase in the prey-predator complex with an interesting pattern of dispersal. The tiger population has increased from 9 in 1975 to 20 (twenty) in 1984, resulting in a high density within Park area and also creating some socio-ecological problems, inviting a serious concern for the wildlife managers.

## Short Description of Study Area

Bandhavgarh National Park lies between 23°36' to 23°43' north latitudes and 80°57' to 81°6'15" east longitudes and is situated in Umaria Tehsil of Shahdol district, Madhya Pradesh, approachable by road, from Umania the nearest railway station, i.e., 35 kms and from Jabalpur, the nearest airport, i.e., 195 kms.

## Forest and Habitat

The Park area is mainly hilly and comprises of a number of hillocks with the Bandhavgarh fort-hill in the centre. Forest of the Park may be divided into—



- a) Sal forests—Constituting 59% of the total area. Sal forests are in climax stage and are broken up by deciduous forests mainly due to edaphic factors. It has semi-evergreen habitat and keeps the area cool in summer as compared to the dry deciduous forests.
- b) Mixed Forests—Occurring on upper hill slopes containing shallow soil and cover nearly 35% of total area.
- c) Grasslands—Grassy patches locally known as Bah occur along the perennial source of water—rivers and nalas. Those meadows cover nearly 6% of total area of the Park.

The area of the Park which mainly lies on hills and undulating ground is covered with dense forests and thick bamboo understorey. This meets the requirements of suitably protective as well as special cover to most of the animals—viz. Sambhar, Cheetal, Chinkara, Chausingha, Nilgai, Gaur, Barking-deer, Wild Boar etc. The Caves on Bandhavgarh fort, slopes and hideouts on other hillocks in the Park along with thick bamboo clumps provide ideal shelter to bear, tiger etc.

#### Status of Tigers—Past and Present

The Park was part of the erstwhile Rewa State. The ex-rulers of Rewa State maintained their all game-reserves (Shikargah) where shooting was practised only for the sake of game and sport. Tiger shooting was mainly done by them. Shooting of wild animals inside Shikargah's was not allowed to the persons other than Ilakedars of the state. The Park was a good reserve owing to variety of game available and special interest taken by the rulers to preserve them.

Rewa State was merged in 1947 in Vindhya Pradesh and again in Madhya Pradesh in the year 1956. 105 sq. km area of the old reserve was constituted as Bandhavgarh National Park in the year 1968 (Vide M.P. Govt. Forest Deptt. Notification No. 2977/x/68 dated 23-3-1968). A census was carried out in 1968 itself to know the approximate number of tigers and other animals in the area. The same was repeated in 1970 also, results are as follows :—

| Species    | No. of animals |              |
|------------|----------------|--------------|
|            | Year<br>1968   | Year<br>1970 |
| Tiger      | 6              | 5            |
| Panther    | 11             | 8            |
| Gaur       | 9              | 23           |
| Bear       | 32             | 30           |
| Sambhar    | 111            | 205          |
| Chital     | 78             | 130          |
| Bluebull   | 27             | 6            |
| Other deer | 169            | 120          |



The Park became an independent unit for wildlife management from the year 1975 as it was given a status of a Forest Division and a Director was posted to look after the area along with other necessary staff.

Regular census works have been carried out every year since then and the prey base has been found as follows :—

| Sl. No. | Species      | Population |      |      |      |      |      |      |      |      |      |
|---------|--------------|------------|------|------|------|------|------|------|------|------|------|
|         |              | 1975       | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 |
| 1.      | Gaur         | 37         | 38   | 19   | 21   | 21   | 18   | 19   | 17   | 17   |      |
| 2.      | Nilgai       | 13         | 48   | 48   | 62   | 73   | 130  | 140  | 138  | 141  |      |
| 3.      | Sambhar      | 205        | 245  | 89   | 220  | 245  | 265  | 314  | 380  | 341  |      |
| 4.      | Chital       | 125        | 283  | 302  | 575  | 749  | 1060 | 1066 | 1105 | 1456 |      |
| 5.      | Barking deer | 50         | 56   | 57   | 65   | 83   | 95   | 79   | 81   | 81   |      |
| 6.      | Chinkara     | —          | 22   | 22   | 35   | 40   | 35   | 29   | 31   | 35   |      |
| 7.      | Chousingha   | —          | 16   | 22   | 32   | 36   | 45   | 45   | 15   | 30   |      |
| 8.      | W. boar      | —          | 110  | 119  | 146  | 214  | 235  | 247  | 222  | 348  |      |
| 9.      | Langoor      | —          | 657  | 715  | 696  | 918  | 3650 | —    | —    | —    |      |
| 10.     | Shaiusm      | —          | —    | —    | 15   | 35   | 72   | 104  | —    | —    |      |
| 11.     | Sehi         | —          | 25   | 25   | 34   | 40   | 55   | —    | —    | —    |      |
| 12.     | Hare         | —          | 32   | 36   | 43   | 42   | —    | —    | —    | —    |      |

Dominant predator for this area is tiger. Though eleven (11) panthers have been recorded in 1968 but a decline was noticed in the subsequent years and they were found only 4 in 80, 81, 82 and 83. It is perhaps due to the rapid increase of tiger population in the area and non-availability of suitable size of prey for the panthers. They could not stand the competition of the tigers here and migrated towards outer and peripheral zones of Park area.



### Population of Tigers in the Park

Census figures for tiger population are as under:—

|          |       | 1975 | 1976 | 1977 | 1978 | 1979 | 1980 | 1981 | 1982 | 1983 | 1984 | Total |
|----------|-------|------|------|------|------|------|------|------|------|------|------|-------|
| ♂        | Tiger | 3    | 7    | 7    | 7    | 5    | 7    | 7    | 8    | 8    | 6    | 65    |
| ♀        | Tiger | 5    | 4    | 4    | 6    | 6    | 7    | 11   | 11   | 11   | 9    | 74    |
|          | Cubs  | 1    | 2    | 2    | 2    | 6    | 8    | —    | 3    | 3    | 6    | 33    |
| Total :— |       | 9    | 13   | 13   | 15   | 17   | 22   | 18   | 22   | 22   | 21   | 172   |

### Census Technique Followed in B.N.P. for Tigers

The area of the Park is divided into 19 units based on territorial habitats of the tiger and for the accuracy of the field work as well. On fixed dates and timings, the enumerators go to their unit, locate the pug marks, lift them by tracing them on tracing paper; they also note the movement pattern of the tiger in the units, collect other evidence—natural kills, actual sighting hearing the rore etc. or other reliable information. All the tracings and other evidence are then collected, data compiled for the whole area. The process is repeated for 2 or 3 days to know the variability in time and the mapping is also done, and the final results are obtained. This was the technique followed every year from 1978 onwards.

### Distribution

Tigers are well distributed throughout the park area except for the southernmost part of the Park where prey base is also poor. Territorial regions are Chorbabra, ( ♂ ) Jamuniba ( ♀ ) with 2 cubs), Chakradhara, Badishesh shaiya ( ♀ ), Bather Rajbahra ( ♀ ) shari, Dudia and nearly hills ( — ), Andhiyari, Jhurria, Bhitari kaitikha ( ♂ and ♀ ), Baghadalaka ( — ), Bhadrasila meadows ( ♀ with 3 cubs ). One thing specially worth mentioning is that all the above regions have a high density of prey base also (Cheetal, Sambhar, Blue Bull etc). It has been observed that the areas having high densitig of prey base, also have evident tiger territories and outer areas having poor prey density, do not show evident tiger territory.

Jamuniba Nala, Chorbahra area, Bhadrasila meadow, Bhitari and Andhiyari have tiger ( ♂ ) territories which is also shared by (female) tigresses. This has been depicted in the attached map of Bandavgarh showing distribution of tigers as found during all India census April 1984.



### Density

Density is the number of animals of a species per unit area. Total area of the Park is 105 sq. km so Tiger population density would be—

| Year | Population      |                 | Density<br>per sq. km | Area per adult animal |
|------|-----------------|-----------------|-----------------------|-----------------------|
|      | Total           | Adults only     |                       |                       |
| 1975 | 9               | 8               | .086                  | 13.13 sq. km          |
| 76   | 13              | 11              | .124                  | 9.55 "                |
| 77   | 13              | 11              | .124                  | 9.55 "                |
| 78   | 15              | 13              | .143                  | 8.08 "                |
| 79   | 17              | 11              | .162                  | 9.55 "                |
| 80   | 22              | 14              | .210                  | 7.50 "                |
| 81   | 18              | 18              | .171                  | 5.83 "                |
| 82   | 22              | 19              | .210                  | 5.53 "                |
| 83   | 22              | 19              | .210                  | 5.53 "                |
| 84   | 21              | 15              | .200                  | 7.00 "                |
|      | 172             | 139             | 1.64                  | 81.25                 |
|      | 17.2 Ave        | 139             | .164                  | 8.125                 |
|      | $\sigma = 4.37$ | $\sigma = 3.62$ |                       | $\sigma = 2.27$       |

Thus the spatial habitat availability varies from 13.13 sq. km per adult tiger to 5.53 sq. km./adult tiger. It seems to be the minimum tolerable limit of an area for an adult tiger. Because after this limit, spacing of adult tigers is conspicuously noticed. This also suggests that "Even under optimum conditions there is a limit to which territories can be compressed", and hence spacing of the population of reproductive resident adult tigers is the probability to occur after this area limit of tolerance.

.21 tigers per sq. km is the highest density for this area (as well highest density in India, perhaps).

- Note:—(1) Standard deviation for the total population is 4.37 suggesting a normal distribution pattern (at 95% confidence limit) from 9 to 26 tigers, similarly adult 7 to 21.
- (2) Standard deviation for area per adult tiger is 2.27 suggesting the area limit (95% c.l.) 4 to 13 sq. km which is also justified. Theoretical maximum density which can also be called saturation point of the tiger for a particular habitat is not known. But the trend of tiger population in this area clearly indicates a symptom of reaching saturation point.



### Rate of Change

The growth rate of population is the number of organisms added to the population per time. Simple rate of change is obtained by the formula.

$$\begin{aligned} \text{Growth Rate} &= \frac{\Delta N}{\Delta t} = \frac{12}{9} = 1.33 \\ \text{,, per tiger} &= \frac{\Delta N}{N \Delta t} = \frac{12}{9 \times 9} = .148 \text{ or } 14.8\% \\ \text{Total Population of tiger in 1975} &= 9 \\ \text{,, ,, 1984} &= 21 \\ \therefore \text{Rate of change for 10 years} &= \frac{21 - 9}{9} = 1.33 \quad (1) \end{aligned}$$

$$\text{Tr} = \frac{T2 - T1}{T1}$$

$$\left. \begin{aligned} T2 &= \text{Population at time } T2 \\ T1 &= \text{,, at } T1 \\ \text{Tr} &= \text{Rate of change during the period } T. \end{aligned} \right\}$$

Accordingly the population should have been 9, 10, 11, 13, 14, 15, 17, 18, 19, 21. But such uniform rates are seldom applicable in biological population. Biological populations are always effected by many factors which sometimes, cause abnormal fluctuations. In a normal range condition there are always some transients criss-crossing in the range to find unoccupied home ranges. The replacement is usually male for male and female for female (Charles Mcdaugal). Such type of movements during census period definitely effect the data collections and thereby affecting the whole analysis of the population dynamics.

To know the central tendency of the population, an average population for the study area (and period also) has been calculated and plotted as the equilibrium (which shows a zero rate of change) and expresses the central tendency during the period studied (Graph 1). Simple linear regression have also been drawn on the graph which is fitted in the fluctuations of the populations observed from 75 to 84.

Population tend to change exponentially which can be given as  $N_t = N_0 (1+r)^t$   
Where  $N_t$  = Population at some future time

$N_0$  = ,, at starting point

$r$  = rate of increase

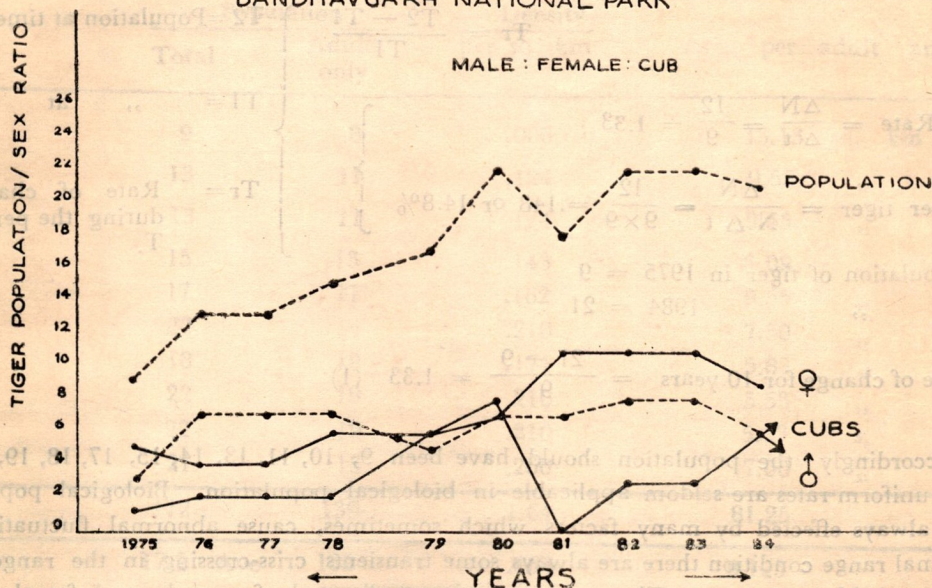
$t$  = time in years

$$\text{Net increase} = \frac{\text{Rate of change} - \text{mortality}}{T}$$



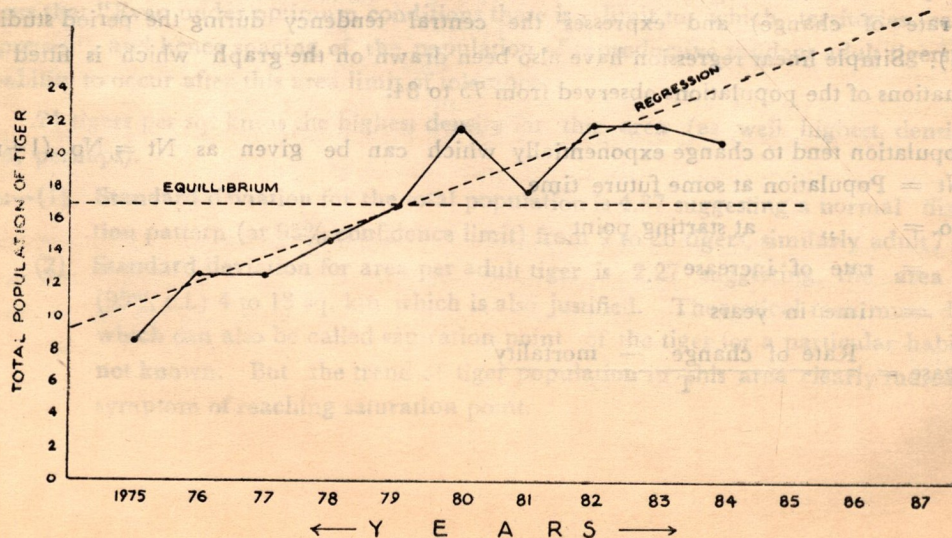
Graph 1

POPULATION TREND OF TIGERS  
IN  
BANDHAVGARH NATIONAL PARK



Graph 2

POPULATION TREND OF TIGERS  
IN  
BANDHAVGARH NATIONAL PARK





Average population = 17.2

„ cub = 3.3

Annual mortality rate = youngs in a stable population.

(In a stable population of animals it is presumed to be equal to the number of youngs.)

$$\text{So } d \text{ (mortality rate)} = \frac{3.3}{17.2} = .192 \quad (2)$$

$$\text{Hence Net increase } r = \frac{1.33 - .192}{10} = .114 \quad (3)$$

Substituting the values of  $r$  we get the following theoretical population of tigers—

9, 10, 11, 12, 14, 15, 17, 19, 21, 24/26, 29, 32 whereas actual is 9, 13, 13, 15, 17, 22, 18, 22, 22, 21

Cubs 1, 2, 2, 2,, 6, 8 — 3, 3, 6

So if the same rate of change continues and other factors are also similar to the study period the future population of tigers should be

| 1985 | 1986 | 1987 | 1988 | 1989 | 1990 |
|------|------|------|------|------|------|
| 26   | 29   | 32   | 36   | 40   | 44   |

But the increase in a population can also not go on indefinitely and any population is bound to level off at a stage determined by the tiger sociology and the resource capacity of the habitat. Actual figures of tiger population also clearly indicate that Bandhavgarh Park with an area of 105 sq. km can support 18-19 adults or (22 tigers including cubs) only.

### Doubling time

How long it takes to a population for doubling is given by

$$td = \frac{\ln 2}{r} = \frac{.6931}{.114} = 6 \text{ years}$$

( $r$  = rate of net increase. For Bandhavgarh tiger population it is .114 as calculated in (3).)  
For example

|                              | Year | Tiger | doubling time 6 years |           |
|------------------------------|------|-------|-----------------------|-----------|
| Starting                     | 1975 | 9     | so                    | 1981 — 18 |
| There Theoretical population |      |       |                       |           |
|                              | 1976 | 10    | 82                    | 20        |
|                              | 1978 | 12    | 84                    | 24        |
|                              | 1980 | 16    | 86                    | 30 etc.   |



### Sex ratio

Sex ratio is the best indicator of procreation. It also influences the mean population body weight and the food requirement (Robert H. Giles Jr.) (W.L. management). The population structure and sex ratio in Bandhavgarh tigers from 1975 to 1984 is as under—

| Years        | 1975     | 1976      | 1977 | 1978      | 1979 | 1980      | 1981 | 1982     | 1983 | 1984     |
|--------------|----------|-----------|------|-----------|------|-----------|------|----------|------|----------|
| Adult ♂      | 3        | 7         | 7    | 7         | 5    | 7         | 7    | 8        | 8    | 6        |
| Adult ♀      | 5        | 4         | 4    | 6         | 6    | 7         | 11   | 11       | 11   | 9        |
| Cub ♂        | —        | 1         | 1    | 1         | 2    | 3         | —    | 1        | 1    | 2        |
| Cub ♀        | 1        | 1         | 1    | 1         | 4    | 5         | —    | 2        | 2    | 4        |
| Total        | 9        | 13        | 13   | 15        | 17   | 22        | 18   | 22       | 22   | 21       |
| Sex :        | 60 : 100 | 175 : 100 |      | 83 : 100  |      | 64 : 100  |      | 73 : 100 |      | 88 : 100 |
| Ratio        |          | 175 : 100 |      | 117 : 100 |      | 100 : 100 |      | 73 : 100 |      | 67 : 100 |
| Male : 100 F |          |           |      |           |      |           |      |          |      |          |
| % M          | 37.5     | 63.6      | 63.6 | 53.9      | 45.4 | 50        | 39   | 42.2     | 42.2 | 40.1     |
| % F          | 62.5     | 36.4      | 36.4 | 46.1      | 54.6 | 50        | 61   | 57.8     | 57.8 | 59.9     |

higher proportion of males

These figures indicate that in a normal population of tiger the proportion of females is a bit higher than that of males. On an average (for 10 years in above table) we find a 88 : 100 male : female ratio or in other words 46.8% males, 53.2% females are represented in tiger population of Bandhavgarh National Park.

If we analyse the sex ratio in cubs we find 65 : 100 males to females, i.e. 39.4% males, 60.6% females among the cubs.

### Natality

Natality is the inherent ability of a population to increase under an actual or specific environmental condition. It varies with the size and composition of the population and physical environmental conditions.

$$\text{Natality rate } B = \frac{\Delta Na}{\Delta t} = \frac{33}{9} = 3.67$$



$$\text{Natality rate per adult female} = \frac{3.67}{74} = .05 \text{ or } 5\%$$

where  $\Delta Na$  = production of new individuals in the population. (Natality rate may be zero or positive but it is never negative.)

Actual birth rate for the tiger in wild conditions are not known. The cubs are taken out by the tigress, when they are nearly 6 months old. Actual sighting is possible at this juncture, if regular tracking is done. Occasionally we may come across the cubs which are below 6 months and are lying in some den or other hiding places in the jungle. But actual births can not be counted in wild conditions.

In this paper different types of natality is being calculated on the basis of actual sightings or pug mark tracings of the young cubs, that have been included in census records.

$$(1) \text{ Net natality} = \frac{\text{Total female young}}{\text{Total female adults}} = \frac{21}{74} = .284$$

$$\begin{array}{ccc} 83 & 84 & (95 \text{ to } 84) \\ 2/11 & 4/9 & 20/74 \\ .182 & .444 & .270 \end{array} \quad (\text{per year } .03)$$

$$(2) \text{ Refined natality} = \frac{\text{Total young}}{\text{Total female adults}} = \frac{33}{74} = .446 \text{ (.05)}$$

$$\begin{array}{ccc} 3/11 & 6/9 & 33/74 \\ .273 & .667 & .446 \end{array}$$

$$(3) \text{ Gross Nr} = \frac{\text{Total } \text{♀} \text{ young}}{\text{Total adults}} = \frac{21}{139} = .154 \text{ (.02)}$$

$$\begin{array}{ccc} 2/19 & 4/15 & 20 \\ & & 139 \\ .105 & .267 & .144 \end{array}$$

$$(4) \text{ Crude Nr} = \frac{\text{Total young}}{\text{Total adults}} = \frac{33}{139} = .237 \text{ (.03)}$$

$$\begin{array}{ccc} 3/19 & 6/15 & 33/139 \\ .158 & .40 & .237 \end{array}$$

Thus (1) to (3) types of natalities are female specific. Sex ratios are important statistics for the analysis of reproductive rates.

Crude Natality is the expression which indicates the relationship between total young and total adults of the population irrespective of sex ratios.

Approximately the rates of all kinds of natality for Bandhavgarh tiger population vary from 2 to 5% per annum.



## Mortality

Refers to death of individual in the population and is equivalent to 'death rate'. Ecological mortality (loss of individuals under a given environmental condition) varies with population and environmental condition. "There is a minimum mortality which represents the loss under ideal condition i.e. even under the best condition individual would die of 'old age'—determined by their physiological longevity". (E.P. Odum, in Fundamentals of Ecology—Toppan Co. Ltd. Tokyo, Japan). Other suspected causes of mortality include energy shortage and starvation, disease, predation, natural catastrophic, accidents (natural and human caused) hunting-trapping, Pollution and Poisoning.

Evidence of mortality is very difficult to find. Sick or injured animals hide, they are naturally inconspicuous, scavengers and decay work rapidly.

In the study area one young ♀ tiger died in truck accident near Tala in the year 1980. One male tiger died in the year 1980 due to natural death but body could not be recovered. Another ♂ was shot dead in October, 1982 as it turned to be confirmed man-eater. One male cub (aged nearly 9 months) died on 26-1-84 due to infection through umbilical cord. No other evidences could be collected during study period. So only these figures can not serve the purpose for calculating the mortality rate.

## Other factors influencing the population dynamics

a) *Availability of prey biomass*:—Calculating and comparing the wild prey biomass from 1977 to 1983 an annual biomass increase is found to be 27364 kg. (In 1977—67870 kg, in 1983—232055 kg Total biomass).

Average population of tiger 14 adult + 3 cubs would require

|                              |          |
|------------------------------|----------|
| 7 kg per day per adult       |          |
| for 14 adults for one year = | 35770 kg |
| 3.5 kg — do —                | 3833 kg  |
| for 3 cubs                   | 39603 kg |

Supposing an average annual increase of biomass of prey animals is available for the tigers, it only fulfills 69% of their total requirement. And hence heavy depredation of cattle by tigers around Bandhavgarh park is the obvious result. On an average 40-50 cattle apart from natural prey will be required annually for this tiger population.

*Supporting evidences*:—A study on cattle lifting problem by the tiger around Bandhavgarh National Park (G.D. Dwivedi—Dissertation paper submitted during D.W.L.M. course 1982-83 Wildlife Institute of India, Dehra Dun) reveals that, on an average 618 cattle are killed annually by tigers around Bandhavgarh National Park. It further states that



6 tigers (3 male and 3 female adults) of the Park area do participate in depredation of cattle of surrounding areas as the home ranges of the said tigers extend from Park area to buffer zone having similar type of composition of forest and habitat. Main difference between these areas can be summarised as below:—

Park area has—

- a) High density of tigers.
- b) Normal distribution of wild prey.
- c) Complete protection from grazing and other biotic factors and reverse is the case, in buffer areas.

Excessive habitat destruction, overgrazing, annual fires, human interferences in buffer area have brought about a pronounced depletion of the wild prey base, forcing the tiger to turn to cattle.

b) *Spacing*:—As discussed in earlier paragraphs, Bandhavgarh Park has a very high density of tigers. Population figures show that during 1982-83 the area available per adult tiger was only 5.5 sq. km where such type of rise occurs in density of predator animal like tiger. Spacing becomes a must as per ecological principles. Forces which bring about the spacing of individuals in a population, play an important role, spacing is mainly due to—

- i) Inter individual composition for resources in short supply.
- ii) Direct antagonism.

So this process (Spacing) in a population tends to reduce the competition for the necessities of life and that is what we see in case of tigers here. To avoid intraspecific confrontations and for food requirements etc. they spread out towards the buffer area.

*Concluding remarks*:—Study of population dynamics of tigers in Bandhavgarh Park give certain useful indications of future trend the said population. High density of tigers, reaching almost saturation level for the area, tends to show 'spacing phenomenon' in the individuals and spreading towards buffer zone. Buffer area—(Consisting of reserve and protected forests) is opened for free grazing, forestry operations, other biotic interferences and over burdened with rights and privileges of the local inhabitants shortage of wild prey base, easy-availability of cattle in the surrounds forces the tigers to turn to cattle.

Preying on domestic livestock to an alarming extent coupled by occasional accidental human killings by tiger is creating a socio-ecological constraint for this tract. Present situation demands a reorientation of the strategies planned for the conservation of wildlife



and reconsiderations for the socio-economic influences on the rural communities of the surrounds.

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# Professionalism in Wildlife Management in India

By

V.B. SINGH

There is no denying that a large section of conservationists in the country not only consider but loudly proclaim that Foresters are not technically competent to manage wildlife. That some of these Foresters have undergone special training for wildlife management, has not contributed much to dispel that general feeling. The plea of the Forester that these 'armchair conservationists' are not qualified or competent to pass any such judgement on them does not hold as it is the Forester who has been entrusted with the responsibility of wildlife management and not the conservationists and as such it is they who have to possess sound technical knowledge to give credibility to their professional competence.

Wildlife management in this country is a new field of science but even so the oldest wildlife organisation in the country is in existence over 30 years—in the State of Uttar Pradesh. In other States they are between 15 to 20 years old. These organisations are certainly old enough to produce if not a large number of competent professionals, at least a noticeable number of recognised experts in the field. Unfortunately the existing picture is very depressing and the future prospects are not as optimistic as one would like it to be. The fact that only a counted few are accepted, on national level as experts in some branch or the other of wildlife management does not auger well for the future well-being of wildlife and for the reputation of Forests as their sound scientific managers.

Conservation needs of wildlife and its habitat call upon its manager to possess a great deal of professional excellence in the field of its management. The seventies have brought about a sea-change not only in the attitude of masses and the Government but also in the activities related to wildlife conservation. Reasonable support, both financial and moral have started flowing for the cause leading to the diverse management activities which till not long ago, were confined to more protection. Status survey of different species of wildlife and its habitat; monitoring the trend of changes; identification of threatened and endangered species and their captive breeding; rehabilitation of rare species in suitable habitats; study and working out management techniques of different kinds of habitats etc. are only a few examples of the multiple activities in which wildlife managers have to be fully conversant. His expertise should imbibe not only theoretical knowledge of various related disciplines but also needs the support of a sustained and long field study. His professionalism has to be reflected in scientific and technical papers of academic and field value, which he produces and gets accepted by recognised journals in the field of nature conservation. In due course he is



bound to earn recognition in the field and name both for himself and to the State wildlife organisation to which he belongs.

It is necessary to take up, as a concrete example, the case of a State and analyse the problem in detail. With this object in view, the oldest Wildlife Organisation in the country—that of Uttar Pradesh—should make an ideal example as apart from one or two exceptions, conditions in almost all the States in the country differ from it only marginally.

The State wildlife preservation organisation in U.P. came into existence in the year 1956, long before any other state in the country thought of setting up a separate organisation for wildlife management. This organisation, initially concerned mainly with protection duties, has expanded man of old both in its jurisdiction and field of activity. It is manned at present by as many as 35 officers and over 1000 staff members. An idea about the expansion of the organisation after 1970 can be had from the fact that out of total strength of 35 officers and 453 wildlife guards as many as 26 officers and 416 were appointed after 1970. However, there has been singular lack of professional achievement corresponding to the increase in the strength of the organisation. It is necessary to identify and enumerate the reasons responsible for this unsatisfactory situation.

The basic foundation on which professionalism can be developed or built up in an individual member of any technical organisation is his continued association for a reasonable long period with that organisation. That, along with his abiding interest in the subject, which he is also likely to develop through long association, under suitable working climate will lead to professional excellence. How far is the wildlife organisation in U.P. geared to create the above conditions, while the subordinate (non-officer) wing of the organisation, except for 15 Forest Rangers, belong to the Wildlife Cadre, the officers manning the organisation belong to the common pool—the cadres of State and Indian Forest Services. Except for certain exceptions, they generally stay in the organisation for two to three years at the most before they are shifted out elsewhere. The following facts in this respect, will be quite revealing.

- (i) During the 6 year period between 1981 to 1987, there have been 9 Chief Wild Life Wardens.
- (ii) During the last three years i.e. from January 1984 to January 1987, as many as 4 Chief Wild Life Warden have already worked and the 5th is in office at the moment.
- (iii) Nearly 50% of the officers have put in just about one year's service in the organisation.



- (iv) There will be hardly 10 officers with more than 3 years stay, of them not more than 2 have put in continuous service in the organisation for more than 5 years.
- (v) Out of a total strength of 437 forest officers (IFS and PFS) only 8 officers have done the special Wild Life Management Course in the Wildlife Institute of India. Of these, two are not working in the wildlife organisation.
- (vi) There is a Research Officer in the Corbett National Park under Project Tiger, but so far he has out of necessity, spent most of his time in tackling and destroying man-eaters.
- (vii) Under the Crocodile Rehabilitation Project the Organisation Provided fellowship to two Ph.D. scholars who have produced valuable thesis and have been awarded doctorate. But this practice has been discontinued now and no research work is being done under the aegis of the wildlife organisation.

### **Suggested Action Plan**

The foregoing factors have very adversely affected the development of the wildlife organisation into a cohesive, purposeful and involved cadre. The fact that most of the officers have only peripheral attachment for short periods does not permit them to absorb the essence of the wildlife conservation movement. They do not get sufficient opportunity to be exposed to the various facets of the technical intricacies inherent in scientific management of wildlife and its habitat. The initial and basic training in wildlife management that they get as part of their over all training as a forest officer is not adequate and can, at best make only wildlife administrators out of time. They are required to be equipped with much more than such superficial and elementary exposure. The following suggestions are made:

#### **(i) Creation of a sub-cadre under the Forest Department**

A stop has to be put to the too frequent to and fro movement of officers from the Wildlife Organisation. This can be achieved only by creating a subcadre in Forest Department in which officers willing to serve in the wildlife cell should be included. The strength of the sub-cadre, its promotional opportunities, field facilities and other details could be worked out, keeping the main objectives in view. Creation of this sub-cadre will provide the much wanted continuity in the field of wildlife management, which in its turn will create opportunity for total involvement in the scientific and technical aspect of the subject.

#### **(ii) Technical Training**

Officers in the sub-cadre should be given adequate specialised training both in the country and outside. Opportunities should be provided to such



officers who are keen to get Ph.D. or other research degrees by providing them with study leave on full pay. It is important that all trained officers are posted in wildlife organisations. Wild Life Institute of India may monitor and keep a watch on its implementation.

(iii) **Research Degree Allowance**

Such officers who procure Ph.D. degree, should be given suitable special monthly allowance. This is done in the case of Engineering Services.

(iv) **Internal Six-monthly technical Seminars**

Every six months all the officers of the organisation should meet at a technical seminar, where each officer will be required to present a technical paper. The paper should give technical data on the subject and should draw tentative/final conclusions.

(v) **Mention in Character Rolls**

Specific mention about the number of Research papers published in recognised technical journals or submitted to the Chief Wild Life Warden should be made in the character rolls of the officers. Such a mention should specially be considered at the time of promotion.

(vi) **Attending Technical Workshops & Seminars**

Officers should be given full opportunities to attend technical seminars and meet scientists and workers in the field of wildlife management. They should also be encouraged to take active part in such seminars where they should present their own papers also.

(vii) **Well equipped library**

The wildlife organisation should have a well equipped technical library. They should contribute and subscribe freely technical journals, both national and international. Each officer should be allowed to have at least a small library with important books and should get at least a couple of relevant journals.

(viii) **Monetary Reward**

A system of awards should be worked out and established for the best three technical papers published or presented each year. Substantial monetary awards will induce the officers to write research papers and will create healthy competition among them.

(ix) **Proper utilisation of Research Officer**

The Research Officer posted in the Tiger Project or in other Projects should be utilised for research work and not for other duties. Other important,



pressing and urgent responsibilities of the organisation should not be permitted to divert the services of the research officer away from his main duty of field research.

(x) **Provision of Research Fellowships**

The State Wildlife Management has a large number of problems and subjects which need data collection, analysis, surveys and research. We can not depend on the Wild Life Institute of India to take up all our problems. They can at the most take up only some of them. The State should provide Fellowships and engage young post-graduates to take up specific problems and subjects for research studies. Youngmen interested in getting Ph.D. will not only provide us with results but their presence and work in the field will generate research culture in the organisation. This helps in involving our own officers and field staff in the much needed process of data collection and analysis.

(xi) **Associating with Research Bodies working in our areas**

A large number of institutions and organisations involved in field research are keen to take up research subjects and surveys in our States concerning wildlife and its habitat. Such recognised institutions, bodies and Universities should be welcomed and encouraged to take up projects in our State. It is necessary that some of our officers are associated with such research work, so that they can learn the methodology and can make positive contribution to that project. Such association can also lead to independent research work by our own officers.

Any further neglect and delay in creating suitable conditions and implementing the above suggestions assiduously to impart due professionalism in the field of scientific wildlife management, will subvert its progress and will expose the Foresters to justifiable criticism. On the other hand the implementation of these suggestions will create an atmosphere in which professionalism in the Organisation will prosper. Given suitable opportunity, encouragement and working conditions, there is no doubt whatsoever that our younger generation of officers will rise to the occasion and achieve excellence in the field of wildlife management. We have already lost a great deal time for lack of proper attention in this field. Now that the realisation about the importance and need of developing professional excellence is positively dawning, though slowly, on all concerned the initiative for devising ways and means to achieve the goal has to come from each State Government. There is no time to lose, if the Wildlife Organisation in the States have to forge ahead and become true instruments for the scientific management of Wildlife.



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- (4) Dy. Conservator of Forests

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Phone No. 79

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**Flamingo flight seen over Dhanpur Wetland District Bhatinda, Punjab.**



*Photos by : Gurmit Singh*

(For reference see Article on Page 17)



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